

The invention claimed is:

1. An apparatus comprising:
a fuel cell stack having a pair of electrodes including an anode and a cathode,
and a thin film electrolyte disposed therebetween; wherein the electrolyte
comprises a solid oxide; and
a catalytic microreactor having (1) a manifold positioned in fluid communication
with the fuel cell stack, the manifold adapted to convey a fuel to the anode and
(2) a catalyst adapted to reform the fuel.
2. The apparatus of claim 1, wherein a distance between at least one of the
pair of electrodes and the catalyst is less than 10 millimeters.
3. The apparatus of claim 2, wherein the distance between at least one of the
pair of electrodes and the catalyst is less than 1 millimeter.
4. The apparatus of claim 3, wherein the catalyst contacts at least one of the
pair of electrodes.
5. The apparatus of claim 4, wherein the catalyst contacts the anode.
6. The apparatus of claim 1, wherein the catalyst is disposed in at least a
portion of the manifold.
7. The apparatus of claim 1, wherein the fuel cell stack and the catalytic
microreactor together comprise a volume less than 1 liter.
8. The apparatus of claim 1, wherein the electrolyte has a thickness less than
10 micrometers.

9. The apparatus of claim 1, wherein the catalyst has a first temperature and the electrolyte has a second temperature during operation of the apparatus, and a difference between the first temperature and the second temperature is less than 200 degrees Celsius.
10. The apparatus of claim 9, wherein at least a portion of the manifold has a third temperature during operation, and a difference between the first temperature and the third temperature is less than 200 degrees Celsius and a difference between the second temperature and the third temperature is less than 200 degrees Celsius.
11. The apparatus of claim 1, wherein the manifold includes at least one wall comprising silicon.
12. The apparatus of claim 1, wherein the manifold comprises a flow passage having at least one dimension less than 5 millimeters.
13. The apparatus of claim 1, wherein a substantially planar substrate defines the manifold.
14. An apparatus comprising:
a fuel cell stack having a pair of electrodes including an anode and a cathode, and a thin film electrolyte disposed therebetween, wherein the electrolyte comprises a solid oxide; and
a catalyst disposed proximate the anode, the catalyst adapted to reform a fuel, wherein a distance between the anode and the catalyst is less than 1 millimeter.
15. The apparatus of claim 14, wherein the catalyst contacts the anode.

16. The apparatus of claim 14, wherein the catalyst is arranged to mix a fuel conveyed to the fuel stack through the catalyst in a first direction and at least one product emitted from the fuel stack through the catalyst in a second direction during operation of the apparatus.
17. The apparatus of claim 16, wherein the catalyst is adapted to accelerate a reaction between the conveyed fuel and emitted product.
18. The apparatus of claim 16, wherein the catalyst is adapted to react with the conveyed fuel to form an incoming fuel substantially free of at least one of water and oxygen.
19. The apparatus of claim 14, wherein the catalyst comprises a plurality of pores oriented substantially perpendicularly to the anode.
20. The apparatus of claim 14, further comprising:
a manifold in fluid communication with the catalyst and adapted to deliver a fuel to the catalyst.
21. The apparatus of claim 20, wherein the manifold comprises at least one flow passage having at least one dimension less than 5 millimeters.
22. A method comprising:
forming a fuel cell stack having a pair of electrodes including an anode and a cathode, and a thin film electrolyte disposed therebetween, wherein the electrolyte comprises a solid oxide;
integrating a catalytic microreactor with said fuel cell stack, wherein said catalytic microreactor comprising (1) a manifold disposed in fluid

communication with the fuel cell stack, the manifold adapted to convey a fuel to the anode and (2) a catalyst adapted to reform the fuel.

23. The method of claim 22, wherein forming the apparatus comprises at least one of photolithography and stamping.

24. The method of claim 22, wherein forming the apparatus comprises sputter deposition.

25. A method comprising:

forming a fuel cell stack having a pair of electrodes including an anode and a cathode, and a thin film electrolyte disposed therebetween, wherein the electrolyte comprises a solid oxide; and

forming a catalyst proximate the anode, the catalyst adapted to reform a fuel, wherein a distance between the anode and the catalyst is less than 1 millimeter.

26. The method of claim 25, wherein forming the fuel cell comprises at least one of photolithography and stamping.

27. The method of claim 25, wherein forming the fuel cell comprises at least one of sputter deposition and evaporative vacuum deposition.